

Case Report

<http://dx.doi.org/10.4070/kcj.2013.43.9.628>
Print ISSN 1738-5520 • On-line ISSN 1738-5555

kcj
Korean Circulation Journal

Endovascular Repair of Aortoiliac Aneurysm Using Bifurcated Stent Grafts with Sandwich Technique for Preserving the Internal Iliac Artery

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In this case, we describe a case of a 76-year-old male with extensive aortoiliac aneurysms treated by endovascular aneurysm repair using the sandwich technique in order to preserve left internal iliac artery perfusion. The sandwich technique refers to the deployment of multiple paralleled stent grafts into main distal and side branches in overlapping with a single proximal stent graft. The procedure was successfully performed without complications. Post-procedural CT angiography demonstrated patent stent grafts without any endoleak. The strengths and limitations of the sandwich technique need to be investigated in large-scale, long-term clinical trials. (*Korean Circ J* 2013;43:628-631)

KEY WORDS: Endovascular procedures; Stents; Aortic aneurysm; Iliac; Aneurysm.

Introduction

Endovascular aneurysm repair (EVAR) of the abdominal aortic aneurysm (AAA) is a less invasive technique, which is as effective as open surgery, but associated with lower mortality and morbidity rates compared to surgical repair.^{1,2)} The distal landing zone of bifurcated stent grafts is usually a common iliac artery (CIA). However, in cases of short or aneurysmal CIA, distal attachment of stent graft can be performed at the level of external iliac artery (EIA) after the embolization of the internal iliac artery (IIA) in order to avoid type II endoleak. However, the occlusion of an IIA, particularly bilateral iliac artery occlusion, can be associated with hip and buttock claudication, erectile dysfunction, and in rare cases, life-threatening complications such as colon ischemia.³⁾ The branched iliac stent-graft is an appealing alternative to avoid IIA occlusion; however, it is an

expensive device that is not currently available in Korea.⁴⁾ The sandwich technique was developed to preserve perfusion to the aorta branches and consists of one larger proximal stent graft deployed in overlapping with multiple distal stent grafts extending to the side branches and the distal main vessel.⁵⁾ A sufficient overlap between the proximal and distal stent grafts and synchronous ballooning of distal stent grafts to prevent type III endoleak is the key to a successful procedure. We describe a case of a 76-year-old male with extensive aortoiliac aneurysms who was successfully treated with EVAR using the sandwich technique in order to preserve IIA perfusion.

Case

A 76-year-old man with a history of hypertension, diabetes mellitus, benign prostate hypertrophy and tobacco use was presented with right flank pain. A retrograde pyelography revealed an extrinsic indentation of the right pelvic ureter. Computed tomography (CT) angiography demonstrated an AAA with bilateral CIA involvement (Fig. 1). The maximal diameter of the distal abdominal aorta was 34 mm and the diameter of the aorta at renal artery level measured 19.2 mm. The right CIA was 55 mm and the left CIA was 24 mm in their maximal diameters. The diameter of the right CIA at its ostium was 27 mm, whereas that of the left CIA was 11 mm.

In this patient, we decided to perform EVAR using a bifurcated stent graft. In order to preserve at least one IIA for pelvic perfusion, we planned to apply the sandwich technique. The right IIA was embolized using a 14 mm Vascular Plug (Amplatzer, St. Jude Medical,

Received: January 15, 2013

Revision Received: March 26, 2013

Accepted: April 1, 2013

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• The authors have no financial conflicts of interest.

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Fig. 1. Abdominal aortic aneurysm with bilateral common iliac artery involvement.

St. Paul, MN, USA) after the engagement of a 7 Fr sheath into the right IIA from the left common femoral artery. The main body of the bifurcated stent graft (Excluder 23-14-160 mm, Gore, Newark, DE, USA) was introduced through the left common femoral artery and deployed below the left renal artery origin.

Thereafter, a tubular-type stent graft (Viabahn 8×150 mm, Gore, Newark, DE, USA) was inserted into the left IIA through a 8 Fr Shuttle sheath from the left brachial artery. An iliac extender stent graft (Excluder 12×140 mm, Gore, Newark, DE, USA) was inserted through the left common femoral artery. The two distal stent grafts were deployed in parallel with the overlapping of the proximal main body stent graft and dilated synchronously by a kissing balloon method (Fig. 2). A contralateral limb (Excluder 12-140 mm, Gore, Newark, DE, USA) and an iliac extender (Excluder 12-100 mm, Gore, Newark, DE, USA) were inserted through the right CFA in order to cover the right CIA and the proximal segment of the right EIA sheath.

After the procedure, angiography showed proper positions of the deployed stent grafts with good blood flow to the left IIA and minimal endoleaks (types Ib and III). Follow-up aorta CT scans taken at 3 days (Fig. 2) and 8 months after the procedure showed patent stent grafts without significant endoleak. During the 8-month follow-up, the patient remained uneventful.

Discussion

Abdominal aortic aneurysms accompanied by CIA aneurysm are generally found in 20% to 30% of AAA patients.⁶⁾ AAAs associated

with shorter CIA are reported to be particularly prevalent among Asians.⁷⁾ These types of AAAs often require more complex procedures, owing to the difficulties in obtaining an adequate distal landing zone for the stent graft limbs; in particular, the size of an iliac artery is much bigger than AAA, as in this study.

Extending the iliac limbs of the stent-graft past the IIA origin may provide a secure seal in these cases. However, bilateral occlusion of IIAs is associated with pelvic ischemia in 12% to 45% of cases, causing complications such as buttock claudication, ischemic colitis, neurological deficits, bowel or bladder dysfunction and impotence.⁸⁻¹⁰⁾ Yano et al.¹⁰⁾ revealed that the risk of pelvic ischemia was much higher in both the IIA occlusion group compared to the one IIA occlusion group.

The sandwich technique is a creative method to expand EVAR feasibility in the setting of adverse or challenging iliac artery anatomy. Its main advantages include no restrictions in terms of CIA diameter or length or IIA diameter.⁵⁾ Cannulating the IIA from the brachial artery and advancing an endograft from the upper extremity is not generally technically challenging. Sealing the commissural angles is apparently achievable, because oversizing the limbs and endografts in relation to the diameter of the main graft will produce a tight apposition of the components.¹¹⁾ So far, there have been only a small number of case reports on the sandwich technique for preserving IIA blood flow. All reported technical access and excellent short-midterm outcomes have been without significant complications.¹²⁻¹⁵⁾ Ricci et al.¹⁶⁾ demonstrated that the sandwich stent graft was still patent at the 1-year follow-up.

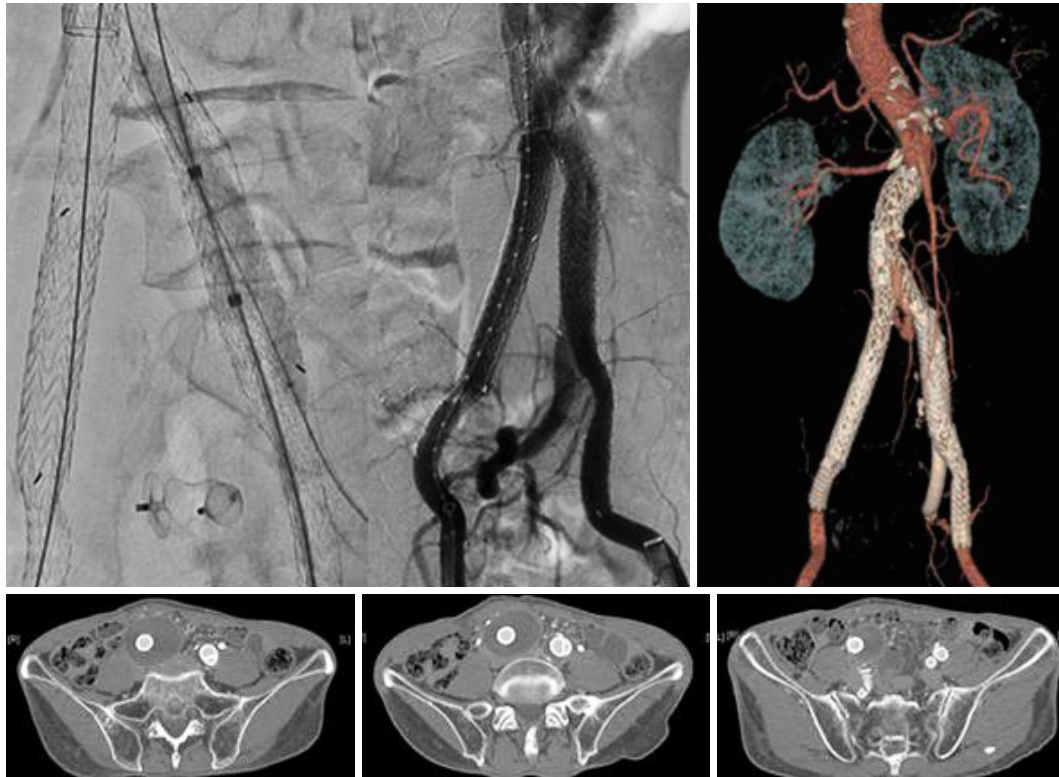


Fig. 2. A Viabahn (8×150 mm) stent graft is inserted to the left internal iliac artery (IIA) through the left brachial artery and an iliac extender (Excluder 12-14) stent graft is deployed in the left external iliac artery through the Lt. common femoral artery sheath. An angiography shows proper positions of the deployed stent grafts with good blood flow to the left IIA and minimal endoleaks (type Ib and III). Follow-up aorta CT scans taken at 3 days after the procedure shows patent stent grafts without significant endoleak.

Endovascular aneurysm repair using a branched stent graft is another option to treat an AAA involving CIA. A branched stent graft can be customized to each patient's iliac artery anatomy. However, it usually takes 2 to 3 months to obtain such custom made products. Currently, branched stent grafts are not commercially available in Korea. By contrast, there is no need to wait for a specific stent-graft to perform the sandwich technique. Moreover, the sandwich technique has a relatively lower cost than the custom made branched stent graft. There are also disadvantages of the sandwich technique: 1) it requires an access from the brachial artery in addition to the femoral arteries accesses; 2) Viabahn stent grafts are generally not much radiopaque so that positioning them requires extra experience; 3) the use of the Viabahn stent graft for the sandwich technique is limited by its available sizes (size range, 9-13 mm in diameter);¹⁶⁾ 4) furthermore, a bailout technique needs to be developed for cases of perigraft leaks.

Basically, we used a similar sandwich technique as Lobato et al.¹⁵⁾¹⁷⁾ previously described. However, this case is unique in that the patient has more prominent aneurysm in the bilateral iliac arteries than in the abdominal aorta. Moreover, there has been no case report on EVAR using the sandwich technique in Korean patients. Therefore, in our opinion, the present case is worth being reported. In

our case, we decide to embolize the right IIA and to apply the sandwich technique for the left iliac arteries. Because the diameter of the left CIA at its ostium was 11 mm, we believed there would be only minimal risk of an endoleak into the aorta in the case of failed sandwich technique. However, if the sandwich technique for the right iliac arteries was attempted and failed, there would be increased risk of endoleak into the aorta due to the large diameter of the left CIA at its ostium (27 mm).

In conclusion, our case indicates that the sandwich technique is a technically straightforward and effective technique for the preservation of IIA circulation. In our opinion, it has the potential to expand the applicability of EVAR for AAA with complex iliac artery anatomies. However, further accumulation of large long-term data is required to prove the safety and efficacy of the sandwich technique.

References

1. EVAR trial participants. Endovascular aneurysm repair versus open repair in patients with abdominal aortic aneurysm (EVAR trial 1): randomised controlled trial. *Lancet* 2005;365:2179-86.
2. EVAR trial participants. Endovascular aneurysm repair and outcome in patients unfit for open repair of abdominal aortic aneurysm (EVAR trial 2): randomised controlled trial. *Lancet* 2005;365:2187-92.

3. Rayt HS, Bown MJ, Lambert KV, et al. Buttock claudication and erectile dysfunction after internal iliac artery embolization in patients prior to endovascular aortic aneurysm repair. *Cardiovasc Intervent Radiol* 2008; 31:728-34.
4. Riesenman PJ, Ricotta JJ 2nd, Veeraswamy RK. Preservation of hypogastric artery blood flow during endovascular aneurysm repair of an abdominal aortic aneurysm with bilateral common and internal iliac artery involvement: utilization of off-the-shelf stent-graft components. *Ann Vasc Surg* 2012;26:109.e1-5.
5. Lobato AC. Sandwich technique for aortoiliac aneurysms extending to the internal iliac artery or isolated common/internal iliac artery aneurysms: a new endovascular approach to preserve pelvic circulation. *J Endovasc Ther* 2011;18:106-11.
6. Armon MP, Wenham PW, Whitaker SC, Gregson RH, Hopkinson BR. Common iliac artery aneurysms in patients with abdominal aortic aneurysms. *Eur J Vasc Endovasc Surg* 1998;15:255-7.
7. Cheng SW, Ting AC, Ho P, Poon JT. Aortic aneurysm morphology in Asians: features affecting stent-graft application and design. *J Endovasc Ther* 2004;11:605-12.
8. Razavi MK, DeGroot M, Olcott C 3rd, et al. Internal iliac artery embolization in the stent-graft treatment of aortoiliac aneurysms: analysis of outcomes and complications. *J Vasc Interv Radiol* 2000;11:561-6.
9. Karch LA, Hodgson KJ, Mattos MA, Bohannon WT, Ramsey DE, McLafferty RB. Adverse consequences of internal iliac artery occlusion during endovascular repair of abdominal aortic aneurysms. *J Vasc Surg* 2000; 32:676-83.
10. Yano OJ, Morrissey N, Eisen L, et al. Intentional internal iliac artery occlusion to facilitate endovascular repair of aortoiliac aneurysms. *J Vasc Surg* 2001;34:204-11.
11. Falkensammer J, Hakaim AG, Andrew Oldenburg W, et al. Natural history of the iliac arteries after endovascular abdominal aortic aneurysm repair and suitability of ectatic iliac arteries as a distal sealing zone. *J Endovasc Ther* 2007;14:619-24.
12. Yoshida Rde A, Yoshida WB, Kolvenbach R, Vieira PR. Modified "stent-graft sandwich" technique for treatment of isolated common iliac artery aneurysm in patient with Marfan syndrome. *Ann Vasc Surg* 2012; 26:419.e7-9.
13. Coppi G, Tasselli S, Silingardi R, Gennai S, Saitta G, Moratto R. Endovascular preservation of full pelvic circulation with external iliac-to-internal iliac artery "cross-stenting" in patients with aorto-iliac aneurysms. *J Vasc Interv Radiol* 2010;21:1579-82.
14. van Groenendaal L, Zeebregts CJ, Verhoeven EL, van Sterkenburg SM, Reijnen MM. External-to-internal iliac artery endografting for the exclusion of iliac artery aneurysms: an alternative technique for preservation of pelvic flow? *Catheter Cardiovasc Interv* 2009;73:156-60.
15. Lobato AC, Camacho-Lobato L. The sandwich technique to treat complex aortoiliac or isolated iliac aneurysms: results of midterm follow-up. *J Vasc Surg* 2013;57(2 Suppl):26S-34S.
16. Ricci C, Ceccherini C, Cini M, et al. Single-center experience and 1-year follow-up results of "sandwich technique" in the management of common iliac artery aneurysms during EVAR. *Cardiovasc Intervent Radiol* 2012;35:1195-200.
17. Lobato AC, Camacho-Lobato L. Endovascular treatment of complex aortic aneurysms using the sandwich technique. *J Endovasc Ther* 2012; 19:691-706.